Section 8.4

SELF-CONSOLIDATING CONCRETE FOR PRECAST/PRESTRESSED CONCRETE PRODUCTS

8.4.1 PURPOSE

This procedure provides guidelines to the Florida Department of Transportation (Department) personnel and other entities that are involved in the Self-Consolidating Concrete (SCC) related laboratory and field trial batches, review of the plants' quality control plans (QCP), and inspection and testing of production concrete.

8.4.2 AUTHORITY

*Sections 20.23(3) (a) and 334.048(3), Florida Statutes **(F.S.)***

8.4.3 REFERENCES

Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, Precast/Prestressed Concrete Institute (PCI) Manual MNL 116

Interim Guidelines for the use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants-TR-6-03, 2003

Florida Department of Transportation Standard Specifications for Road and Bridge Construction

8.4.4 SCOPE

This procedure establishes guidelines for the Department personnel who are involved in the SCC related inspection and testing activities, including, reviews of the proposed QCP, concrete mix designs, laboratory and field trial batch verifications, and inspection and testing of production concrete.

8.4.5 PLANTS' PROPOSED CONCRETE MIX DESIGNS

8.4.5.1 Specified 346 Class Concrete

The use of SCC for the fabrication of precast concrete is allowed as a replacement for the 346 class concrete when the Contract Documents allow its use or its use has been approved by supplemental agreement (SA) or change order. For the fabrication of the non-prestressed/precast concrete products of the current projects, the contractor may propose the use of SCC concrete mixes. Upon the Department's approval, the use of SCC will be allowed.

Similar to the conventional 346 HRWR admixture mixes, for precast concrete products, the proposed 346 class SCC concrete mixes require the State Materials Office's approval. The District Materials Offices review the proposed concrete mix designs and verify if they meet the requirements of the ***346 Specifications***, including the following:

(1) Concrete mix ingredients are from Department approved source.

(2) The High Range Water Reducer (HRWR) admixture meets Type I or Type II admixture requirements of ***Section 924*** of the ***Specifications***. The addition of the admixtures shall comply with the recommendation of the manufacturer of the admixtures.

(3) The performance records of the Viscosity Modifying Admixture (VMA) are available, if it is proposed to be used to attain desired stability and flow characteristics. The records should show that the VMA is compatible with other admixtures and it does not have adverse effect on the hardened concrete properties.

(4) The proposed target slump flow does not exceed 27.0 in [685 mm]. For the 346 class concrete ensure that concrete meets the allowable water-to-cementitious materials ratio and plastic property test requirements prior to the addition of the SCC admixtures.

(5) The volume ratios of fine-to-total aggregates (SA) do not exceed 50 %.

(6) For the SA of less than 45%, the use of VMA is a requirement.

(7) The maximum amount of cementitious materials in the proposed mix should not exceed 1.2 times the minimum allowable amount that is

specified in ***Table 3*** of ***346 Specifications*** for particular class of concrete.

(8) The water-to-cementitious materials ratio does not exceed 0.45.

(9) Forming materials shall be shall be strong enough to withstand the concrete pressure and prevent any material leakage.

8.4.5.2 ASTM or AASHTO Class Concrete

The District Materials Offices review and approve the mix designs for the precast concrete products that require American Society for Testing and Materials (ASTM) or American Association of State Highway Transportation Officials (AASHTO) specified strength requirements. The proposed SCC mix design shall meet the requirements of ***Item Numbers (1) – (9)*** of ***8.4.5.1***, with exception of ***Item No.7***. For the ASTM and AASHTO class of concrete, the maximum amount of cementitious materials in the proposed mix should not exceed 1.2 times the minimum allowable amount that is specified in the aforementioned specifications for particular class of concrete.

8.4.6 PROPOSED QUALITY CONTROL PLANS

The proposed quality control plans should address proposed laboratory and field trial batches, including the following:

(1) The proposed concrete materials ingredients, batching sequence, and their initial and total mixing times.

(2) The proposed inspection and test methods for the laboratory and field trial batches should be included in the quality control plan.

(3) Verify the method of maintaining aggregate moistures.

(4) The personnel performing the required SCC inspection and testing should be familiar with the SCC test methods and specification requirements.

8.4.7 LABORATORY TRIAL BATCH VERIFICATION

(1) Verify the proposed batching sequence and mixing time.

(2) Verify the proposed concrete mix properties, including slump flow, T_{50}, Visual Stability Index (VSI), J-ring tests, air content, density, temperature,

bleed tests, and any other tests that the plant has proposed to use for the quality control of the production concrete. The term, T_{50}, is the time it takes for the outer edge of concrete spread to reach a diameter of 500 mm from the time the mold is first raised. It provides a relative measure of the unconfined flow rate of the concrete mixture. For similar materials, T_{50} gives an indication of the relative viscosity of SCC mixture.

(3) Verify the filling ability, stability, and passing ability of SCC, if these tests will be used for the quality control of production concrete.

(4) Verify that the compressive strength test cylinders are taken. The mix design should include testing of 4 x 8-in and 6 x 12-in cylinders, if the Contractor wants to use 4 x 8-in size cylinders for the quality control testing.

8.4.8 FIELD TRIAL BATCH VERIFICATION

(1) Verify the field trial batches by casting partial or full scale mock-up of the proposed precast concrete products.

(2) Verify that the plastic property tests, including, slump flow, T_{50}, VSI, air content, temperature, density, J-ring tests, and bleed tests. Other tests shall be performed if the Contractor plans to use them for the quality control of the production concrete.

(3) Verify that the slump loss tests are performed to determine the workability of concrete during the delivery and placement of SCC.

(4) Perform the inspection of the saw-cut sections of the SCC. Observe the aggregate distribution of the saw-cut and core samples. Verify that the concrete is free from any sign of honeycombs, cracks, aggregate segregation, and any other defects.

(5) Verify that the hardened concrete property tests meet the requirements of the specifications.

(6) Perform surface resistivity and rapid chloride permeability tests on the core samples or test cylinders.

(7) Submit the verified 346 class concrete mixes to the State Materials Office for approval.

(8) The District Materials Office approves the ASTM and AASHTO specified

class of concrete and sends a copy of the approved mix design to State Materials Office.

8.4.9 PRODUCTION BATCH VERIFICATION

(1) The inspector should check the forms to be stable and leak proof.

(2) Concrete shall stay plastic and within slump flow tolerance range during placement.

(3) Ensure that Contractor has proper plan for the, continuous mixing, delivery, and placement of concrete to prevent excessive slump loss or cold-joints.

(4) Verify that the SCC is delivered in a continuous and timely manner and within the time limit that is allowed by the specification and trial batch verification.

(5) Verify that the following tests are performed for each LOT

(a) Slump Flow
(b) T_{50}
(c) Air Content
(d) Temperature

(6) Verify that the SCC is placed without any vibrations, unless unexpected delays occur between different batches. The contractor should have vibrating equipment available to consolidate the concrete.

(7) The free fall distance of SCC should not exceed the allowable limit that is specified in the specification.

(8) Ensure that the concrete should not overflow.

(9) Verify that water is not added to re-temper the concrete.

(10) Verify that appropriate curing method is applied as soon as practical.

(11) Verify that the finished concrete show the surfaces without any honeycomb, voids, lack of bonding between concrete and reinforcing steel.

8.4.10 TRAINING

None needed.

8.4.11 FORMS

None needed.